

## REMARKS

Claims 10-22 are pending in the present application. No claims have been amended. Applicants respectfully request consideration of the claims in light of the present remarks.

### I. Arrangement of the Specification

In response to the request to conform the Specification to the requirements set forth in M.P.E.P. § 608.01(a) and 37 C.F.R. 1.77, applicants have herein amended the Specification to include the following section titles: “Background of the Invention,” “Brief Summary of the Invention,” “Brief Description of the Figures,” “Detailed Description of the Preferred Embodiments” and “Examples.”

### II. Rejection of Claims 10-20 Under 35 U.S.C. § 103(a)

Claims 10-20 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Soviet Patent SU 981314 to Kudryavtse (“SU 314”). Applicants respectfully traverse.

The present invention is directed to, *inter alia*, a method for manufacturing aminoguanidine bicarbonate by reacting an aqueous solution of cyanamide with hydrazine, followed by addition of CO<sub>2</sub>, which is advantageous over the prior art, *e.g.*, in that it does not require the use of a large excess of cyanamide. In fact, the present invention recites a process for manufacturing aminoguanidine bicarbonate requiring a deficit of cyanamide relative to hydrazine (the molar ratio is less than 1), as recited in, *e.g.*, claims 10-20. Further, claims 21 and 22 recite a virtually spherical aggregate of aminoguanidine bicarbonate crystals that result from the process claimed in claims 10-20.

First, the previously submitted Abstract of Soviet reference SU 981314 neither discloses nor suggests the processes of the present invention. The Office Action acknowledges that “[t]he difference between SU 314 and the rejected claims is that, while the rejected claims recite that the molar ratio of the cyanamide to the hydrazine is smaller than 1, SU 314 teaches cyanamide with hydrazine hydrate in molar ratio of 1.25-1.81.” (See Office Action at page 3).

Second, there is no suggestion or motivation in the SU 314 translation to make any required modification to the processes taught by the SU 314 translation to arrive at the presently claimed invention. Nowhere does the SU 314 translation suggest that the processes it teaches could be modified by altering the molar ratio of cyanamide to hydrazine hydrate to less than 1.25:1, *e.g.* below 1, as featured by the present invention and as recited in claims 10-22 of the present invention.

The present Specification points out that it was previously known in the art to use cyanamide in great excess of hydrazine hydrate, because placing cyanamide in contact with hydrazine in an alkaline medium is known to lead to dimerization of the cyanamide, and hence a lower yield of the desired aminoguanidine bicarbonate product. (See Specification at page 1). Moreover, all of the references cited in the present Specification teach that the ratio of cyanamide to hydrazine should be far greater than 1. (See *id.* at page 2). Among the references discussed therein is SU 314.

In fact, the SU 314 translation itself teaches away from the use of cyanamide in a low molar ratio to hydrazine, *e.g.*, less than 1. The SU 314 translation discloses that “[t]he yield of aminoguanidine bicarbonate falls when the cyanamide:hydrazine ratio is reduced below 1.25:1.” (SU 314 translation at page 3).

The SU 314 translation teaches one of ordinary skill in the art that reducing the ratio of cyanamide to hydrazine causes the yield of aminoguanidine bicarbonate product

to drop. Therefore, for at least these reasons, one of ordinary skill in the art, viewing the SU 314 translation, would not be motivated to arrive at the present invention, which features a molar ratio of cyanamide to hydrazine of less than 1, as recited in claims 10-20 of the present invention.

Third, even if, only for the sake of argument, one of ordinary skill in the art were to modify the teachings of the SU 314 translation, the teachings of the SU 314 translation provide no reasonable expectation of success in such a modification. As discussed above, because the SU 314 translation teaches that lowering the molar ratio of cyanamide to hydrazine to less than 1.25:1 results in decreased yield, there is no suggestion or motivation in the SU 314 translation for one of ordinary skill in the art to modify the teachings of that reference by providing a molar ratio of cyanamide to hydrazine of, e.g., less than 1, as specifically recited in, e.g., claims 10 and 20 of the present invention.

Both the suggestion and expectation of success must be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). "Obvious to try" is not the standard under § 103. Exploration of a new technology or general approach that seems to be a promising field can at the same time be "obvious to try" but legally nonobvious under § 103. *In re O'Farrell*, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988). A mere obvious to try is not enough to establish *prima facie* case of obviousness; there must be a reasonable expectation of success. *Amgen, Inc. v. Chugai Pharmaceutical Co. Ltd.*, 927 F.2d 1200 (Fed. Cir. 1991).

Here, the SU 314 translation specifically teaches that a molar ratio of cyanamide to hydrazine of less than 1.25:1, e.g., less than 1, is not favored. (SU 314 translation at page 3). Based upon this teaching, one of ordinary skill in the art could not reasonably expect success from such a modification.

Even if, only for the sake of argument, the teachings of the SU 314 translation *might* make a molar ratio of cyanamide to hydrazine of, *e.g.*, less than 1 “obvious to try,” that is not the standard for obviousness, and it does not render the presently-rejected claims obvious.

Therefore, applicants respectfully submit that the rejection of claims 10-20 under 35 U.S.C. § 103(a) has been overcome, and respectfully request that it be withdrawn.

III. Rejection of Claims 21 and 22 Under 35 U.S.C. § 103(a)

Claims 21 and 22 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Soviet Patent SU 981314 to Kudryavtse (“SU 314”), because “one of ordinary skill in the art would expect that the reaction products of the claimed invention, and that of SU 314 to be necessarily the same, absent some unexpected property.” (*Office Action* at page 4). Applicants respectfully traverse.

Applicants respectfully submit that the SU 314 translation does not characterize the form and/or size of its products, and, in particular, does not mention that the products of its processes are a virtually spherical aggregate of aminoguanidine bicarbonate crystals with a mean diameter of between about 80 and about 500  $\mu\text{m}$ , as recited in independent claim 21 of the present invention. For at least these reasons, such particles would not have been obvious to one of ordinary skill in the art upon reviewing the SU 314 translation.

Therefore, applicants respectfully submit that the rejection of claims 21 and 22 under 35 U.S.C. § 103(a) has been overcome, and respectfully request that it be withdrawn.

## CONCLUSION

In light of the above remarks, applicants respectfully submit that the claims are now in condition for allowance, early notice of which is earnestly sought.

No fee, other than the fee for extension of time, is believed to be due for this Request. If any fee is due, please charge such fee to Pennie & Edmonds, LLP Deposit Account No. 16-1150.

Respectfully submitted,

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## SPECIFICATION OF AN INVENTION for an Inventor's Certificate

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(54) METHOD OF OBTAINING AMINOGUANIDINE BICARBONATE

The method relates to an improved method of obtaining aminoguanidine bicarbonate, which is used as a stabilizer of photoemulsions, a reagent in analytical chemistry and an intermediate for synthetic dyestuffs.

Several methods of obtaining aminoguanidine bicarbonate are known. The most widely used is a method based on the reaction of condensation of cyanamide and hydrazine (generally hydrazine sulphate) in an aqueous medium in the presence of bases and isolation of the final product with ammonium or sodium carbonates-bicarbonates [1].

The need to use a cyanamide solution of high concentration (~110 g/l), the formation of a significant amount of secondary products (mainly dicyandiamine) as a

consequence of over-alkalization of the reaction mass, and the low quality and yield of the target product, may be regarded as disadvantages of this method.

A method of obtaining aminoguanidine bicarbonate is known which is comprised in that an aqueous solution of cyanamide (with a cyanamide nitrogen content of 50-80 g/l), solid hydrazine sulphate and gaseous ammonia are fed simultaneously and continuously into the reaction zone, where a temperature of 50-90°C and a pH of 7.2-8.5 are maintained with a 1:(1.05-1.5) molar ratio of hydrazine to cyanamide and precipitation is performed with bicarbonate. The target product is obtained with a purity of 98.7-99.7% and a yield of 80-87% relative to hydrazine [2].

A disadvantage of the known method is the difficulty of accurate simultaneous metering of solid, liquid and gaseous components, the formation of effluents with a large amount of inorganic contaminants, and the long process time (20-25 h).

Closest to the invention in technical substance and the result achieved is a method of obtaining aminoguanidine bicarbonate which comprises the reaction of an aqueous solution of cyanamide (with a cyanamide nitrogen content of 34 g/l), hydrazine sulphate and concentrated ammonia solution, using a 1:2 molar ratio of hydrazine and cyanamide, for 3 h at a temperature of 19-25°C under a vacuum of 10-15 mm Hg. Gaseous carbon dioxide is then introduced into the reaction mass at the same temperature until the pressure rises to 28 atm, after which it is left to stand for 66 h. The yield of target product is 80% [3].

Disadvantages of said method are the complexity of the technological process and the apparatus required, the long process time and the inadequately high yield of the target product.

The object of the invention is to increase the yield of the target product, and to intensify and simplify the process.

The stated object is achieved by a method of

obtaining aminoguanidine bicarbonate which comprises the reaction of an aqueous solution of cyanamide with hydrazine hydrate, using a cyanamide:hydrazine hydrate molar ratio of (1.25-1.8):1, while continuously treating the reaction mass with carbon dioxide at a temperature of 80-85°C for 30-40 min., and then at a temperature of 35-40°C for an hour.

The distinguishing feature of the method is the use, as the hydrazine derivative, of hydrazine hydrate with a cyanamide:hydrazine hydrate molar ratio of (1.25-1.80):1 while continuously treating the reaction mass with carbon dioxide at a temperature of 80-85°C for 30-40 min., and then at a temperature of 35-40°C for an hour.

The yield of aminoguanidine bicarbonate falls when the cyanamide:hydrazine hydrate ratio is reduced below 1.25:1; an increase in the ratio above 1.8:1 is undesirable, since the consumption of cyanamide rises without an increase in the yield of the target product.

Performing the process of condensation of cyanamide and hydrazine hydrate at 80-85°C for 30-40 min., and the process of isolation of aminoguanidine bicarbonate at 35-40°C for an hour is optimal in respect of final product yield.

Carrying out the process of obtaining aminoguanidine bicarbonate using the method now proposed makes it possible: to simplify the technological process by excluding the use of vacuum and pressure and to simplify the apparatus used; to reduce the process time by 64 h (from 69 h to 5 h), i.e. to intensify the process substantially; to raise the yield of target product from 80 to 95%; and to improve working conditions as a consequence of excluding the use of a solid starting material - hydrazine sulphate.

**Example 1.** 4.08 g (0.127 mole) of 64% aqueous hydrazine hydrate solution is added with mixing at 30°C to aqueous cyanamide solution, with a cyanamide nitrogen concentration of 35 g/l, containing 9.6 g (0.229 mole) of cyanamide. The molar ratio of hydrazine and cyanamide is 1:1.80. Immediately after charging, carbon dioxide is



bubbled through the reaction mass at a rate of 2.5 l/h, and the mixture is heated to 80-85°C and held at this temperature for 35 min. Condensation of the hydrazine hydrate with the cyanamide occurs, with the formation of aminoguanidine.

The temperature of the reaction mass is then lowered to 35-40°C and the target product is isolated over an hour with a continuous flow of carbon dioxide. The supply of carbon dioxide is stopped and the reaction mixture is cooled to a temperature of 5°C, stirred for 3 h and filtered. The precipitate is washed with 30 ml of cooled water and dried. 16.55 g of aminoguanidine bicarbonate with a purity of 99.7% are obtained.

The yield of product relative to hydrazine is 95%.

**Examples 2 and 3.** Using a 1.52:1 and a 1.25:1 molar ratio of cyanamide and hydrazine, other conditions being the same as in Example 1, 99.5% purity aminoguanidine bicarbonate is obtained with a yield relative to hydrazine of 90.5% and 85%.

## C l a i m

Method of obtaining aminoguanidine bicarbonate which comprises the reaction of cyanamide with a hydrazine derivative in an aqueous medium at elevated temperature with subsequent treatment of the reaction mass obtained with carbon dioxide, characterized in that, with the object of increasing the yield of the target product and of intensifying and simplifying the process, hydrazine hydrate is used as the hydrazine derivative, with a cyanamide:hydrazine hydrate molar ratio of (1.25-1.80):1, while continuously treating the reaction mass with carbon dioxide at a temperature of 80-85°C for 30-40 min., and then at a temperature of 35-40°C for 1 h.

Sources of information considered in the examination

1. Methods for obtaining reagents and specially pure substances. Handbook. Moscow, NIITEKhim, IREA, No. 4-5, pp. 11-14, 1962.
2. USSR Inventor's Certificate No. 230810, cl. C 07 C 133/10, 1968.
3. German Patent No. 689191, cl. 120 17/04, published 1940 (prototype).